

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029**

SUBJECT: Rationale for 70% Impervious Surface Indicator used in the RDA
Petition Response

FROM: Liz Ottinger, Environmental Engineer
NPDES Permits Branch (3WP41)

TO: FILE

On July 10, 2013 EPA received a Petition requesting that Region 3 exercise its residual designation authority (“RDA”) to perform a blanket designation of all currently unregulated commercial, industrial and institutional activities, located near impaired waters. The Petition contained a voluminous amount of supporting data, of a general nature, and not entirely related to Region 3 states, particular watersheds, or specific facilities. The sheer volume of data and lack of specificity of a particular area of concern for the requested designation required the Region to develop an analytical approach to evaluate the entire Region 3 area, within a relatively short period of time. To perform the required analysis of the entire Region in the context of the Petition, the Region developed an “Indicator” for those areas and activities (commercial, industrial and institutional) which could contribute to violations of water quality standards from stormwater runoff.

EPA Region III researched the amount of impervious surface typically associated with facilities of the industrial, commercial and institutional categories to determine a proportion of impervious cover (IC) to be used when analyzing data as to enable a response to the RDA Petition. The documents identified below were utilized in the Region’s decision-making process, which selected 70% impervious cover as an indicator for industrial, commercial and institutional land uses.

The Petition groups together three different types of land uses, namely: commercial, industrial and institutional land uses. There is a considerable amount of research on the commercial and industrial land use types; however, less research exists for the institutional land use category. While commercial and industrial land uses have been found in prior academic research to have relatively similar and consistent percentages of IC, institutional land uses are very diverse and cover a broad spectrum of activities such as churches, schools and municipal functions. Because of their varied uses and locations (urban, suburban, rural), some may have associated fields, lawns and other pervious surfaces, while others may be highly impervious. This causes “the institutional and open land categories to exhibit greater variability in impervious cover than other land use categories.”¹ Our limited academic research identified the following

¹ From “*Impervious Cover and Land Use in the Chesapeake Bay Watershed*” by Karen Cappiella and Kenneth Brown.

percentages of IC associated with the institutional category: 50% (Moglen and Kim); and 27.6% to 40.5% (Capiella and Brown). Moreover, it has been my observation in Region 3 that the number of institutional properties is fewer than those within the commercial and industrial categories. The variability, inadequate existing data, and relative number of parcels of land within the institutional category of land use have all been factored into our IC analysis.

Cappiella and Brown compiled the table below for various locations around the Region.

Table 4.2 Impervious Cover Study Results by Location					
Land Use	Lancaster County, PA	Baltimore County, MD	Howard County, MD	James City County, VA	Chesapeake Bay Average
Agriculture	1.8%	N/A	1.5%	2.3%	1.9%
Open Urban Land	4.2%	9.8%	10.9%	10.3%	8.6%
2 Acre Lot Residential	10.4%	8.7%*	N/A	12.7%*	10.6%
1 Acre Lot Residential	13.3%	14.9%	13.2%	15.7%	14.3%
%Acre Lot Residential	24.6%*	17.7%	19.5%	19.2%	21.2%
...Acre Lot Residential	28.9%	29.8%	25.4%	25.0%*	27.8%
1/8 Acre Lot Residential	33.0%	N/A	37.2%	30.2%	32.6%
Townhome Residential	38.5%	43.3%	40.9%	39.3%	40.9%
Multifamily Residential	42.1%	48.5%	48.7%	40.2%	44.4%
Institutional	40.5%	33.3%	34.9%	27.6%	34.4%
Light Industrial	47.8%	55.4%	53.6%	60.7%	53.4%
Commercial	72.1%	79.2%	78.3%	65.6%*	72.2%

N/A: Land use not sampled

*numbers differ significantly from the mean

(Table 4.5 Cappiella and Brown)

(Note: In the development of the 53.4 percentage of IC for industrial activity in the Chesapeake Bay watershed, Cappiella and Brown measured the percent of IC for only “light industry” noting the absence of “heavy industry”. They also noted that the 72.2.percent figure for commercial reflected the absence of “regional malls”).

Further academic research reviewed establishes that there is an expected range of IC among commercial and industrial land uses in that it can generate 50 percent to 95 percent impervious coverage. One source of data reported 85% IC for commercial land use and 72% IC for industrial land use (Moglen and Kim). Still another source reported a state-wide average of 70% IC from three watersheds (Kaplan and Ayers). This report, which focused on New Jersey, addressed only industrial and commercial, but not institutional land uses. Additionally, in a

recent California data analysis, most commercial and industrial sites were correlated with IC of approximately 80%.

The studies discussed above report a range from 53.4% (which represented an area with no heavy industry) to 95% for the industrial and commercial land use categories. Such a range is reasonable given the fact that every particular location presents individual characteristics that are reflected in the types and density of industrial and commercial activities present there. Developing a percentage of IC as an indicator of industrial and commercial activity involves the use of professional judgment and discretion and is not purely a mathematical analysis. Region 3 has analyzed the applicable research and regional characteristics and has determined that 70% IC is a reasonable figure to utilize as an indicator for industrial, commercial and institutional activities for the purposes of analyzing the vast amount of data supplied by the Petitioners in order to provide a reasonable response to the Petition.

In its analysis, Region 3 reviewed and relied on the following documents:

1. Nonpoint Education for Municipal Officials, Technical Paper No.1 *“Addressing Imperviousness in Plans, Site Design and Land Use Regulations”* by Jim Gibbons.
2. *“Limiting Imperviousness: Are Threshold-Based Policies a Good Idea?”* by Glenn Moglen and Sunghee Kim.
3. Chesapeake Stormwater Network Technical Bulletin No.3 *“Implications of the Impervious Cover Model”*.
4. *“Impervious Surface Cover Concepts and Thresholds”* by Marjorie Kaplan and Mark Ayers.
5. *“Impervious Cover and Land Use in the Chesapeake Bay Watershed”* by Karen Cappiella and Kenneth Brown.
6. *“User’s Guide for the California impervious Surface Coefficients”*, Ecotoxicology Program, Integrated Risk Assessment Branch, Office of Environmental Health Hazard Assessment, California EPA, December 2010.